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1. Administratively, all roads in Poland are divided into the following categories:
 - (1) State
 - (2) Wojewodztwo
 - (3) Powiat
 - (4) Gmina (Township)
2. State roads connect Warsaw with cities designated as wojewodztwo cities and with main highway and main highway arteries running into adjacent countries. Surfaces are improved (asphalt, stone paving blocks, clinkers). Surface width, on an average, is 7.50 meters and shoulder width is 1.5 to 2.0 meters on each side. Embankment width is 12 meters, and grade is 3 to 8 per cent. Horizontal curvature with a minimum of 300 meters, permits a traveling speed of 85 kilometers per hour.
3. Wojewodztwo roads connect wojewodztwo cities with other wojewodztwo cities and with the more important powiat cities. Most of these roads are hard-surfaced roads on solid stone foundation. It is difficult to state the condition of surfaces inasmuch as conditions change from year to year. Width of the roadway is from 5.5 to 6.5 meters; width of embankment is nine meters; grade is four to 10 per cent; horizontal curvatures in most cases are 150 meters. During the German occupation, a number of the wojewodztwo roads running from east to west were widened to 7.5 meters, and the surfaces were improved with tar and dolomite or hard-limestone chips.
4. Powiat and gmina roads are either concrete or improved dirt roads depending upon local conditions and requirements. Generally speaking, the condition of these two categories of roads becomes worse from west to east. Minimum width of such roadways is five meters; grades are six to 12 per cent; width of embankments is 7.5 meters.

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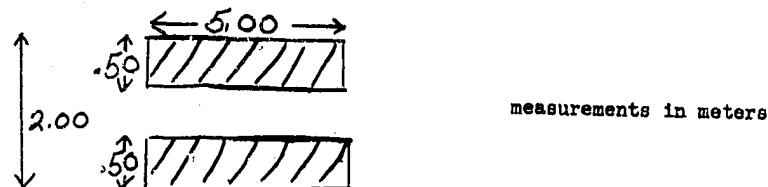
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5. A typical cross section of a highway from the surface downward would include a layer of rolled crushed stone forming a hard surface of 14 to 18 centimeters deep, followed by 18 to 22 centimeters of a stone foundation, on top of 18 to 20 centimeters of sand or gravel. Some surfaces had another top layer of stone paving-block 8 to 11 cm thick, or a two-layer asphalt cover four cm and two cm thick, or concrete slabs 12 to 18 cm thick. When one of the latter three surfaces was used the crushed stone layer immediately beneath it was kept at eight to 10 cm rather than 14 to 18 cm as described previously.
6. From a technical standpoint (capacity, load capacity, visibility, etc), roads are divided into three classes:
 - (a) Class I, includes state roads and better wojewodztwo roads
 - (b) Class II, includes wojewodztwo roads
 - (c) Class III, includes all other roads with improved surfaces.
7. Today, it is difficult to establish the load capacity of individual roads because of the destruction of bridges during World War II. In each case, however, load capacity of bridges on Class I roads can be established as 40 tons (40,000 kilograms), distributed according to the following sketch:



The above also covers Class II roads running in an east and west direction.

8. During the summer, roads are accessible to all vehicles. If the surface is not improved, however, there is the problem of laying dust. During the winter, it is necessary to place snow fences running parallel to the road in certain sectors, otherwise snow must be removed from the road. During the period from 1940 to 1942, [redacted] sectors of the Warsaw-Krakow road covered with snow two to three meters deep. In such cases, it becomes necessary to use the help of a permanent highway service which knows where drift areas are. As a general rule, sectors of roads lying on banks lower than 1½ meters and shallow areas are subject to snow drifts. So-called spring fissures occur on most of the wojewodztwo roads during the spring. This is common also to most of the powiat roads. Spring fissures result from cracking of road surfaces by freezing of foundations occasioned by poor drainage.
9. During the spring (especially in March), heavy vehicular traffic could cause complete destruction of road surfaces. In case of necessity, mats of straw or thin dry twigs are used to maintain heavy traffic over damaged susceptible areas; these areas are well known to the highway service. The battle with spring fissures is almost hopeless once they have started. Their prevention depends upon the installation of stone drains, and drainage of water from under the surface; this requires major repairs in some sectors.
10. There is a shortage in highway equipment resulting from loss of equipment to retreating German armies. The remainder of equipment, furthermore, was shipped into the USSR. The shortage of road rollers is especially felt. There are also certain difficulties in procuring stone materials. Poland has no stone quarries in the area north of the Pilica River and east of the Vistula River. Limestone and sandstone found in the Kielce stone quarry can be used with good results as foundations and in many cases as surfaces if used with tar. A method used by the German army during its troop movements produced good results. By this method the top layer of rolled surface was increased with a layer of

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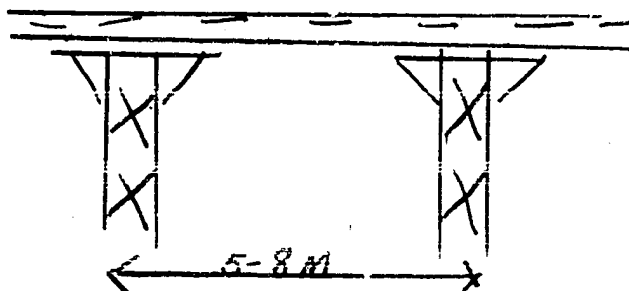
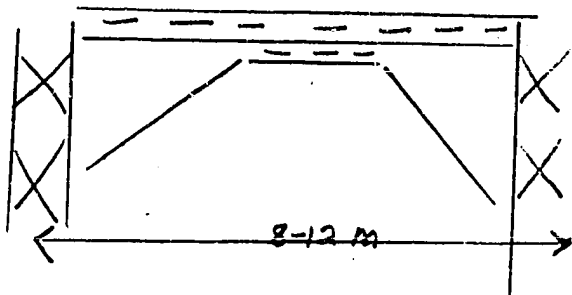
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crushed stone about four to 10 centimeters in thickness (limestone of average hardness); openings were filled and closed with sand and large amounts of water and left for a period of 1 to 1½ months. The surface was then cleaned with steel brushes and sprayed with 2 to 2½ kilograms of gas works tar which was stabilized with an immediate covering of hard limestone chips using eight to 12 kilograms per square meter of surface. This type of surface is very resistant to heavy traffic at high speed during the first year. In the following year, it is necessary to apply ½ to one kilogram of tar and 8 to 10 kilograms of chips. The speed at which the work can be done must be emphasized. A crew of about 30 with two road rollers (eight tons and five tons) roll 500 to 600 linear meters of surface with a width of 7.5 meters daily. Tarring depends only on the speed of transportation and heating of tar. The cost is low and trained workers are not needed. Thus, local manpower can be utilized.

Bridges

11. Highway bridges in Poland, as in all of Europe, were planned according to circumstances. Spans were determined from studies of the minimum and maximum flow of water, excluding floods. Studies were based on annual records of water flow, statements of witnesses, and study of the condition of terrain features. With the exception of bridges over mountainous streams where the study of water flow was difficult, damages or destruction in practice did not occur. An excellent example of destruction where bridge construction accompanied unfamiliarity with local conditions was the disaster of a highway bridge over the Vistula River near Sandomierz. This bridge was built by the German army in the Winter of 1939 directly after the close of the war in Poland (the original steel bridge was destroyed by the retreating Polish army). The reconstructed bridge was destroyed during the Spring ice break in 1940, and highway transportation was cut off for a long period of time.
12. Because of terrain features and the lowland character of rivers, single two-girder truss-bridges were used commonly, chiefly with a lower roadway.
13. On powiat and gmina roads, wooden bridges are most frequently of the trapoidzoid-braced, or girder design.



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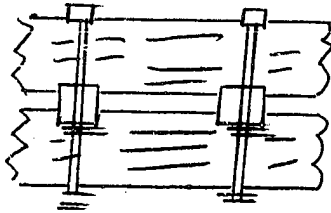
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14. Special attention should be given to wooden bridges because they are ideal temporary structures, because of the availability of wood, and because of a large number of experienced carpenters. [] steel bridges only in a general way because of the possibility of using military bridges. [] omit entirely concrete and reinforced concrete bridges as being unsuitable in transitory conditions. They are destroyed easily, difficult to repair, and require a long time to be repaired.

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15. Standard wood used for bridges is pine and fir in 18 x 24-centimeter beams. Beams of these measurements are plentiful in the forests, and they can be used in their natural state. To attain a greater load capacity, beams are connected with oak wedges and pegs.



16. The roadway is covered with underplanks (pine, fir), eight to 12 centimeters thick and with top planks, four to six centimeters (commonly of oak).
17. Width of the bridge depends on the width of the road (surface).
18. Pile supports are of wood (pine), with a diameter of 30 to 35 centimeters. The length depends upon requirements, eight to 15 meters. The position of the girders corresponds, on an average, to the position of the piles. The average load capacity of a pile, 30 centimeters in diameter, is 30 tons (30,000 kilograms). Piles are driven in with steam rams and in emergency cases, by hand.

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